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NEW ZEALAND PATENTS ACT 1953

No: 522300

Date: 25 October 2002

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COMPLETE SPECIFICATION

A DOOR OPENER DRIVER ASSEMBLY

We, ANZON AUTODOOR LIMITED, a company duly incorporated under the laws of New Zealand of Customhouse, Level 9, 50 Anzac Avenue, Auckland, New Zealand, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to a door opener drive assembly and to related components, subassemblies and uses.

Door openers such as those that might be used for curtain, sectional or tilt garage doors frequently employ a logic controlled DC or an AC motor to drive the movement of the door through a transmission. The transmission may be to a rotating shaft of a curtain door or a tambour type or to a tracked carriage associated with a sectional or tilt door.

In many existing garage door assemblies the transmission includes a flexible driving element such as a chain or belt. Therefore one of the components of the drive train is usually a sprocket or pulley.

Hitherto drive assemblies utilising a carried electric motor has involved the difficulty of aligning the motor so as to have an output shaft in concert or parallel to that of the sprocket or pulley rotational axis (whether through a reduction gearbox or otherwise) to derive power therefrom or, and this is more usual, requires some transmission capable of allowing the rotational axis of the motor to be disposed at some oblique or right angle to the rotational axis of the sprocket or pulley.

The present invention is preferably related to the latter type arrangement.

Existing arrangements of which the present invention is believed to be an improvement give rise to significant stresses in the assembly insofar as the transmission is concerned between the motor and the sprocket or pulley. It is to this region of the transmission that preferably the present invention is at least primarily directed with a view to providing an enhanced resistance to such forces involved without undue complexity, cost and/or bulk.

In a first aspect the present invention consists in a **drive assembly** of or suitable for use in a door opener transmission from a motor, comprising or including

a supported axle member,

a sleeve carried by the axle member so as to rotate coaxially thereabout (irrespective of whether or not the axle itself is allowed to rotate), said sleeve defining or having a worm gear coaxial with the sleeve axis and having one end adapted to engage a complementary sprocket, pulley or the like drive for a flexible drive element such as a chain, belt or the like,

a worm driveable directly or indirectly by the or a motor, said worm meshing with the worm gear of the sleeve, and

a sprocket, pulley or the like member engaged with said end of the sleeve so as to rotate with the sleeve about the sleeve axis.

As used herein the term "door" should be considered in the broadest possible sense, e.g.; can include windows, shutters, tambours, etc.

Preferably the axle is a not stub axle and is fixed at each end thereof to components which co-act to define an assembled or unitary chassis.

Preferably said sleeve is a unitary member preferably moulded from a suitable plastics material.

Preferably said worm gear of the sleeve is spaced from the end adapted to engage.

Preferably said end adapted to engage is splined or keyed and preferably the sprocket, pulley or the like has a complementary spline or key.

Preferably components of the assembly or subassemblies of the assembly are of a kind substantially hereinafter described with reference to any one or more of the accompanying drawings or parts thereof.

In another aspect the present invention consists in a drive assembly of or suitable for use in a door opener transmission from a motor, comprising or including

a first chassis component,

a second chassis component supported (directly or indirectly) so as to hold a fixed position with respect to the first chassis component,

an axle member supported at each end by said first and second chassis components,

a sleeve carried by the axle member so as to rotate coaxially thereabout between the first and second chassis components (irrespective of whether or not the axle itself is allowed to rotate), said sleeve defining or having a worm gear coaxially with the sleeve axis and having one end adapted to engage a complementary sprocket, pulley or the like drive for a flexible drive element such as a chain, belt or the like (or optionally itself defining or having such a sprocket, pulley or the like [e.g.; integrally moulded]),

a worm rotatably mounted relative to and/or by at least said first chassis component so as to be driveable by the motor, said worm meshing with the worm gear of the sleeve,

(optionally) said motor,

and

a said sprocket, pulley or the like member between said first and second chassis components engaged with said end of the sleeve (or optionally of the sleeve) so as to rotate with the sleeve about the sleeve axis.

As used herein the term "component" in respect of the first, second and any other chassis components can include a unitary formed member (e.g.; of plate metal) or a structure fabricated by any means from more than one piece or assembled as a subassembly.

For example, a preferred form of chassis assembly that involves both said first and second chassis components includes a third component at least in part interposed between the first and second chassis components through which the axle member passes and through which part of the sleeve passes but on either side of which is the sprocket, pulley or the like and the worm gear such that said worm gear is interposed between the first and third chassis components and the sprocket, pulley or the like is interposed between the second chassis component and the third chassis component.

Preferably the motor is supported by a motor support member mounted from the first chassis component and the third chassis component.

Preferably a shaft that carries the worm is supported at each end by part of the first chassis component and by part of and/or through motor support member.

In another aspect the present invention consists in a drive assembly of or suitable for use in a door opener transmission from a motor, comprising or including

a first chassis component,

a second chassis component supported (directly or indirectly) so as to hold a fixed position with respect to the first chassis component,

an axle member supported at each end by said first and second chassis components,

a sleeve carried by the axle member so as to rotate coaxially thereabout between the first and second chassis components (irrespective of whether or not the axle itself is allowed to rotate), said sleeve defining or having a worm gear coaxially with the sleeve axis and having one end adapted to engage a complementary sprocket, pulley or the like drive for a flexible drive element such as a chain, belt or the like (or optionally itself defining or having such a sprocket, pulley or the like [e.g.; integrally moulded]),

a worm rotatably mounted relative to and/or by at least said first chassis component so as to be driveable by the motor, said worm meshing with the worm gear of the sleeve, and

a said sprocket, pulley or the like member between said first and second chassis components engaged with said end of the sleeve (or optionally of the sleeve) so as to rotate with the sleeve about the sleeve axis, and

(optionally) also said motor drivingly connected to said worm, and

(optionally) a chain, belt or the like drivingly connected to said sprocket, pulley or the like, and

(optionally) an idle sprocket, pulley or the like for the chain, belt or the like, and

(optionally) a door connected or connectable carriage driveable by said chain, belt or the like.

In still another aspect the present invention consists in a door assembly having a drive assembly of any of the kinds herein, an operable motor, a chain, belt or the like engaging respectively the sprocket, pulley or the like, said chain, belt or the like being capable of acting directly on the door or some carriage that in turn acts on the door.

In some forms of the present invention the arrangement can be such as to drive a roll where the door is rolled.

In still a further aspect the present invention consists in a sleeve substantially as hereinafter described with reference to Figures 6 and 7 of the accompanying drawings.

In still a further aspect the present invention consists in chassis components, subassemblies or the like of any of the kinds hereinafter described with reference to any one or more of the accompanying drawings.

In still a further aspect the present invention consists in a **sprocket and worm gear assembly** substantially as herein described with reference to any one or more of the accompanying drawings.

In still a further aspect the present invention consists in as a **subassembly** for or of a door (such as a garage door) involving any of the apparatus herein described.

As used herein the term "and/or" means "and" or "or", or both where the circumstances allow.

As used herein the term "(s)" following a noun means both or either the plural and singular forms of that noun.

As used herein the term "/" between nouns (e.g. as used hereinafter as "opening/closing" means both the opening and closing functions or either.

For the purpose of the use of systems of the present invention in garage door openings reference is drawn to the website of www.merlingo.com/ as demonstrating apparatus and forms appropriate for such control.

A preferred form of the present invention will now be described with reference to the accompanying drawings in which

Figure 1 is an exploded diagram of apparatus in accordance with the present invention,

Figure 2 is a plan view of an assembly of the components of **Figure 1**,

Figure 3 is a side elevational view of the apparatus of **Figure 2**,

Figure 4 is a section on "AA",

Figure 5 is a section on "BB",

Figure 6 is one view of a preferred unitary moulded sleeve in accordance with the present invention defining a sleeve having a worm gear and a spline capable of engaging a complementary sprocket or the like,

Figure 7 is a view of the moulded member of **Figure 6** from a different direction,

Figure 8 is a view of a sprocket of the assembly capable of being spline driven, and

Figure 9 is a diagram for use in our explanation of some functions and logic features of a preferred implementation of the present invention.

In the preferred form of the present invention the preferred components are as depicted in the accompanying drawings in which, formed in each instance from plate steel so as to perform their respective functions insofar as the present invention is concerned as well as ancillary functions in respect of control systems etc., are the first chassis component 1, the second chassis component 2 and the third chassis component 3.

The third chassis component 3 carries a pole 15 shown in part which has the function of spacing an idle sprocket from the drive sprocket 9 so that the endless chain can drive a carriage guided by the pole 15, that carriage in any suitable way (including those known) being linked to the door to be opened and/or closed by the apparatus.

As can be seen, the third chassis component 3 has an opening therethrough through which can pass the axle 5 as well as part of the sleeve 4 so that the splined or keyed end region 11 of the sleeve 4 can drivingly be received by the mating spline or key 12 of the sprocket 9. The sleeve also has integrally moulded therewith (e.g.; in nylon or acetyl plastic or phosphorus bronze) (see Figures 6 and 7) the worm gear 10 which meshes with the worm 15 (e.g.; of stainless steel or nylon or acetyl plastic) drivingly carried on the output shaft 7 from the motor (preferably AC but can be DC) 8 which is mounted to both the first and third chassis components by a motor support member 6 coupled to the electric motor.

Not described in detail but shown at least to some extent are some of the additional components preferably utilised where an AC motor drive is utilised for the purposes of safety and moment limitation. These operate as is well known in the garage door opening art.

As can be seen, provision is made in each of chassis components 1 and 2 for endwise location and fixing (by screws 14 and 13 respectively) of the axle 5, although in other forms of the present invention, any of the forms of end location of the axle member herein described can instead be utilised irrespective of whether or not they are the same at each end.

As shown in Figure 1 are a variety of washers, thrust bearings and the like but overall it can be seen that little in the way of componentry is required with the system in accordance with the present invention when compared with those hitherto utilised.

It can also be seen that by having a significant span between the ends of the axle member 5 there is good resistance moment to any stresses placed through the sleeve 14 by the worm 15 against movement of the support for the worm gear. This provides significant advantages over previously constructions.

As will be appreciated any appropriate mount for the ends of the axle member can be provided. For example whilst a axially engaging screw at each end is shown in the drawings, persons skilled in the art will appreciate how, if desired, a frustoconical end region or some equivalent can be received by one or other of the first and second chassis components and some means be provided to locate the other end (whether the same or different). For example, frustoconical, domed or other profiled ends at each end could be appropriately received directly by plates profiled accordingly or thrust washers or the like associated therewith. There is no need for the mounting at each end to involve a screw engagement.

Persons skilled in the art will appreciate how by having each end of the axle member fixed (preferably without the axle member being able to rotate relative to either the first or second chassis component) there is considerable moment provided against any torsional stresses that might be introduced by the worm and/or sprocket that result from forces lateral to the sleeve and axle axes. This allows a significantly reduced structural support arrangement as disclosed to be utilised.

A description of the function and some underlying logic of the door controller limit system in one preferred or optional embodiment will now be described. It may use systems and hardware as disclosed in our New Zealand Patent Specifications 522174 or 522578 filed 22 October 2002 and 12 November 2002 respectively, or indeed any mounting, assembly, subassembly and system we have disclosed by way of publication or use in respect of our MERLIN™ brand door systems.

Operation before setup

The manual control button ideally requires to be continuously depressed to move the door. Successive presses result in reversal of door travel direction. This ensures that the door can not accidentally be moved beyond the correct physical end-points of travel.

Set up

To define the limit positions the following process should be performed:

- move the door to the desired open or closed limit position
- store that position in memory
- move the door to the other desired limit position
- store that position in memory

Operation after setup

A brief press of the manual control button will move the door from one limit to the other. Pressing the manual control button while the door is moving stops the door.

Controller overview

The following controller inputs, outputs, and parameters are relevant:

- the state of the reference switch: either 0 or 1
- the state of the motor control relays: opening, closing, or stopped
- the state changes of the position sensor: 0 or 1 for every k mm of door position (where k is a constant dependent on gearing, and type of sensor)
- time
- motor current

From these the controller can infer the position, speed and direction of the door's travel. With knowledge of the motor's torque-speed, and torque-current, characteristics the load placed on the motor can be inferred for any position of the door's travel.

If the controller has been reset, it can not determine whether its stored relative position is correct so it must recalibrate to the reference position. In order to decide which direction to travel first it checks the state of the reference switch and then moves towards the reference point. Once the reference switch has changed state, normal operation resumes. The user will be unaware of this unless they stop the door and try to move the door in the opposite direction before the reference switch changes state. In this circumstance the user will be required to continuously depress the manual control button.

On every uninterrupted operation from a limit position the counter will be set to zero at the reference switch. The counter values for the open and closed limits will be referenced to the newly calibrated reference position. See Figure 9.

Adaptive travel adjustment

The motor speed and/or current is stored with door position during setup. If during normal operation within a short distance of the bottom limit the speed and/or current does not match the stored values within some percentage then the physical limit position is judged to have been altered. The new limit position replaces the old limit position counter value.

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What we claim is:

1. A drive assembly for use in a door opener transmission from a motor, comprising or including

a supported axle member, wherein said axle member is fixed at each end thereof to components which co-act to define an assembled or unitary chassis,

a sleeve carried by the axle member so as to rotate coaxially thereabout, said sleeve defining or having a worm gear coaxial with the sleeve axis and having one end with or adapted to engage a complementary sprocket or pulley drive for a flexible drive element such as a chain or belt,

a worm driveable directly or indirectly by a motor, said worm meshing with the worm gear of the sleeve, and

a said sprocket or pulley of or engaged with said end of the sleeve so as to rotate with the sleeve about the sleeve axis.

2. An assembly of claim 1 wherein said sleeve is a unitary member preferably moulded from a suitable plastics material.

3. An assembly of any one of the preceding claims wherein said worm gear of the sleeve is spaced from the end adapted to engage.

4. An assembly of any one of the preceding claims wherein said end adapted to engage is splined or keyed.

5. An assembly of claim 4 wherein the sprocket or pulley drive has a complementary spline or key.

6. An assembly of any one of the preceding claims wherein components of the assembly or subassemblies of the assembly are of a kind substantially herein described with reference to any one or more of the accompanying drawings or parts thereof.

7. A drive assembly for use in a door opener transmission from a motor, comprising or including

a first chassis component,

a second chassis component supported (directly or indirectly) so as to hold a fixed position with respect to the first chassis component,

an axle member fixed at each end thereof by said first and second chassis components,

a sleeve carried by the axle member so as to rotate coaxially thereabout between the first and second chassis components, said sleeve defining or having a worm gear coaxially with the sleeve axis and having one end with or adapted to engage a complementary sprocket or pulley drive for a flexible drive element such as a chain or belt ,

a worm rotatably mounted relative to and/or by at least said first chassis component so as to be driveable by the motor, said worm meshing with the worm gear of the sleeve,

(optionally) said motor,

and

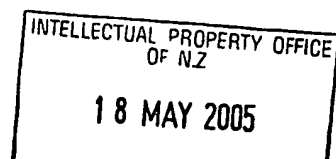
a said sprocket or pulley member between said first and second chassis components engaged with said end of the sleeve (or of the sleeve) so as to rotate with the sleeve about the sleeve axis.

8. An assembly of claim 7 wherein said sleeve and complementary sprocket, pulley or the like drive are defined by being integrally moulded as one unitary part so as to rotate coaxially thereabout between the first and second chassis components.

9. An assembly of claim 7 wherein the term "component" in respect of the first, second and any other chassis components can include a unitary formed member (e.g.; of plate metal) or a structure fabricated by any means from more than one piece or assembled as a subassembly.

10. An assembly of claim 7 or 8 wherein chassis assembly involves both said first and second chassis components and includes a third component at least in part interposed between the first and second chassis components through which the axle member passes and through which part of the sleeve passes but on either side of which is the sprocket or pulley drive and the worm gear such that said worm gear is interposed between the first and third chassis components and the sprocket or pulley drive is interposed between the second chassis component and the third chassis component.

11. An assembly of any one of claims 7 to 9 wherein the motor is supported by a motor support member mounted from the first chassis component and the third chassis component.



12. An assembly of any one of claims 7 to 10 wherein a shaft that carries the worm is supported at each end by part of the first chassis component and by part of and/or through motor support member.

13. A drive assembly for use in a door opener transmission from a motor, comprising or including

a first chassis component,

a second chassis component supported (directly or indirectly) so as to hold a fixed position with respect to the first chassis component,

an axle member fixed at each end thereof by said first and second chassis components,

a sleeve carried by the axle member so as to rotate coaxially thereabout between the first and second chassis components, said sleeve defining or having a worm gear coaxially with the sleeve axis and having one end adapted to engage a complementary sprocket or pulley drive for a flexible drive element such as a chain or belt,

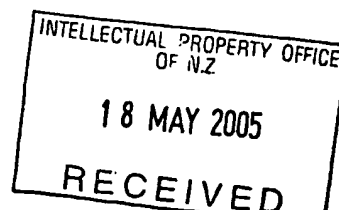
a worm rotatably mounted relative to and/or by at least said first chassis component so as to be driveable by the motor, said worm meshing with the worm gear of the sleeve, and

a said sprocket or pulley drive member between said first and second chassis components either engaged with said end of the sleeve or of the sleeve so as to rotate with the sleeve about the sleeve axis.

14. An assembly of claim 12 wherein said sleeve and complementary sprocket or pulley drive are defined by being integrally moulded as one unitary part so as to rotate coaxially thereabout between the first and second chassis components.

15. An assembly of claim 12 wherein said sprocket or pulley drive member between said first and second chassis is engaged with said sleeve so as to rotate with said sleeve about the sleeve axis.

16. An assembly of claim 12 or 13 wherein said sprocket or pulley drive member between said first and second chassis components is engaged with said motor drivingly connected to said worm.



17. An assembly of claims 12 to 14 wherein said sprocket or pulley drive member between said first and second chassis components drivingly connected to a chain or belt.

18. An assembly of claims 12 to 16 wherein an idle sprocket or pulley drive is provided for the chain or belt.

19. An assembly of claims 16 or 17 wherein chain or belt, drivingly connected to said sprocket or pulley drive member between said first and second chassis components is engaged with a door connected or connectible to a carriage driveable by said chain or belt.

20. A door assembly having a drive assembly of any one of claims 1 to 18 wherein there is, an operable motor, a chain or belt engaging respectively the sprocket or pulley drive, said chain or belt being capable of acting directly on the door or some carriage that in turn acts on the door.

21. An assembly of any one of the preceding claims wherein the arrangement can be such as to drive a roll where the door is rolled.


22. A sleeve substantially as herein described with reference to Figures 6 and 7 of the accompanying drawings.

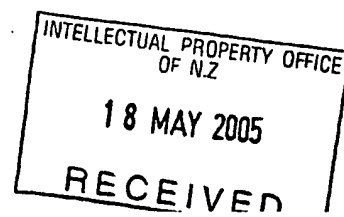
23. Chassis components, subassemblies or the like of any of the kinds herein described with reference to any one or more of the accompanying drawings.

24. A sprocket and worm gear assembly substantially as herein described with reference to any one or more of the accompanying drawings.

25. A subassembly for or of a door (such as a garage door) involving any of the apparatus of claims 1 to 21 herein described with reference to any one or more of the accompanying drawings.

26. An assembly of any one of claims 1 to 21 having a character substantially as herein described with reference to the accompanying drawings.

DATED THIS 17th DAY OF May 2005
AJ PARK
PER 
AGENTS FOR THE APPLICANT



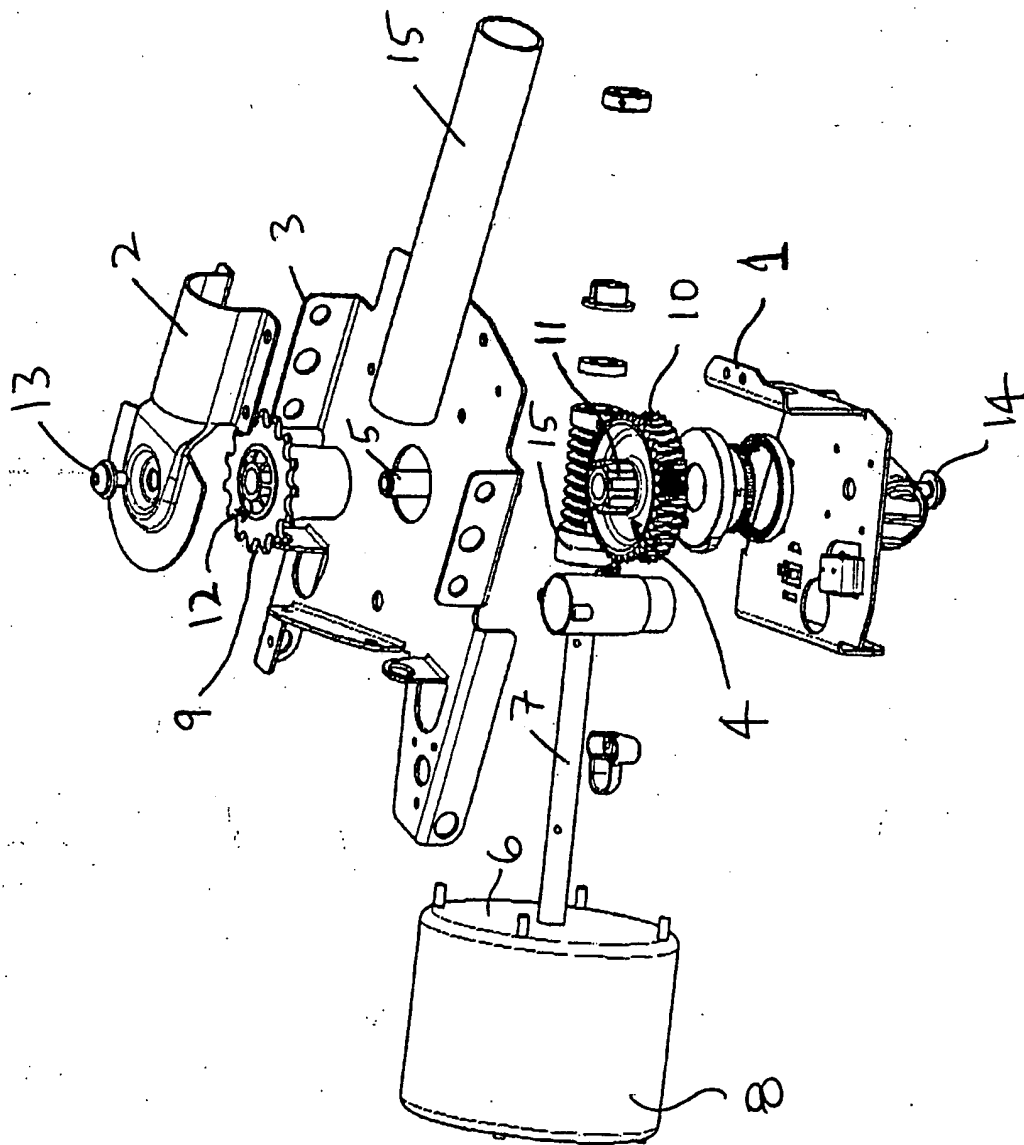


Fig 1

Fig 2

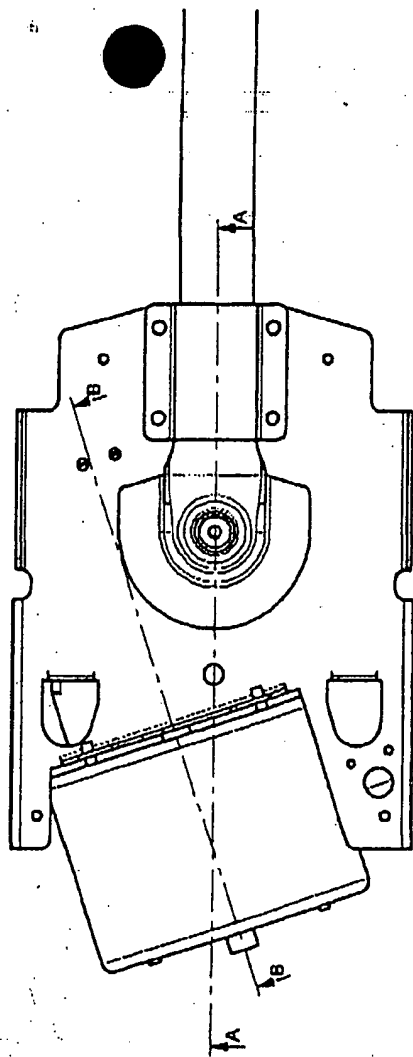


Fig 3

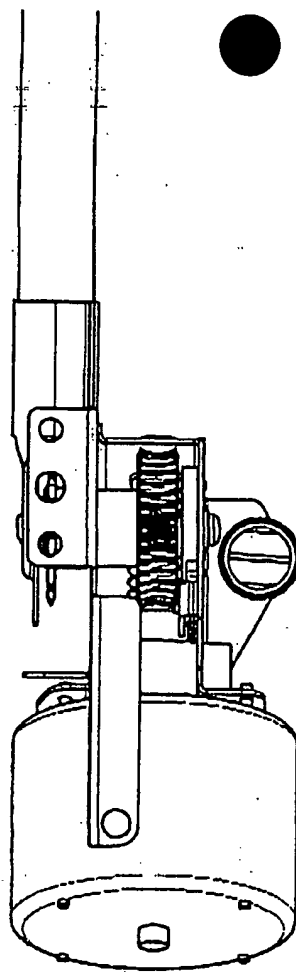


Fig 5

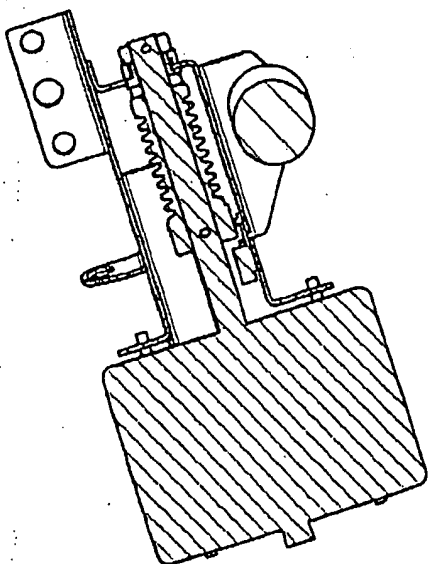
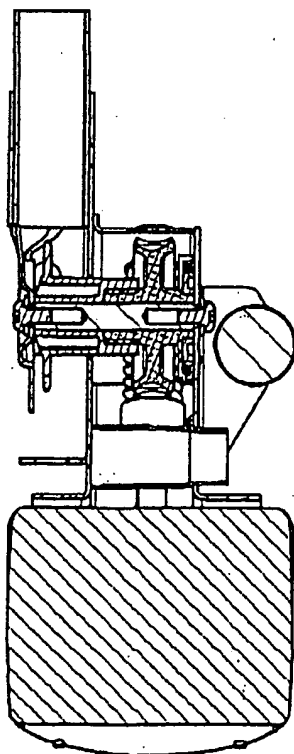


Fig 4



B-B

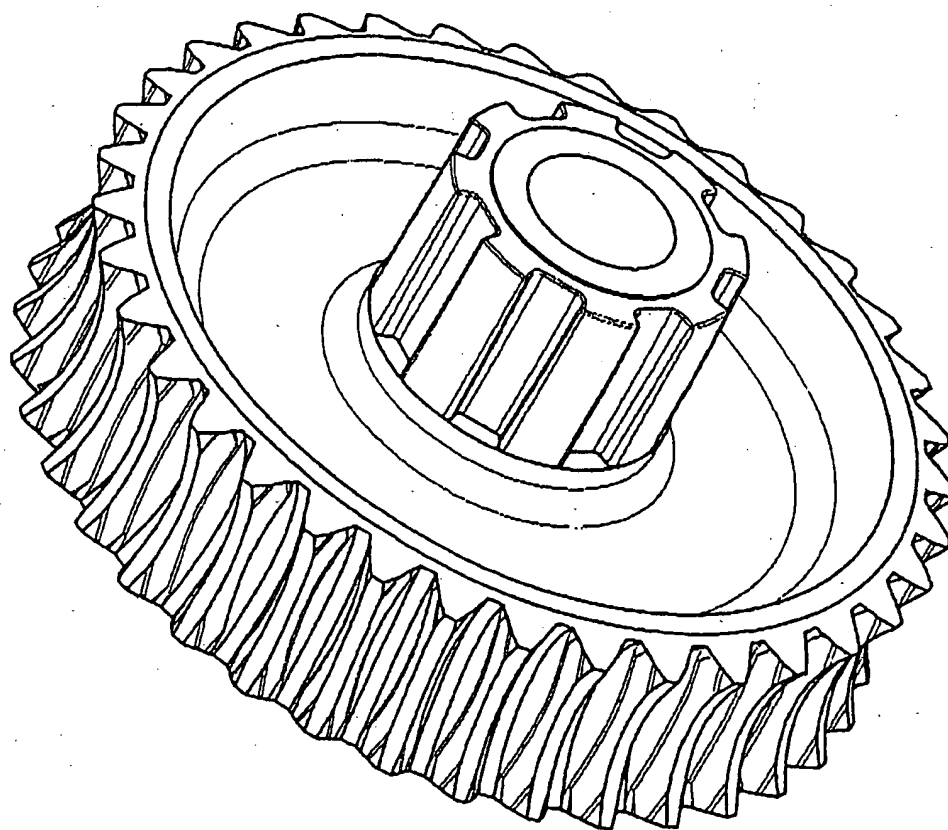
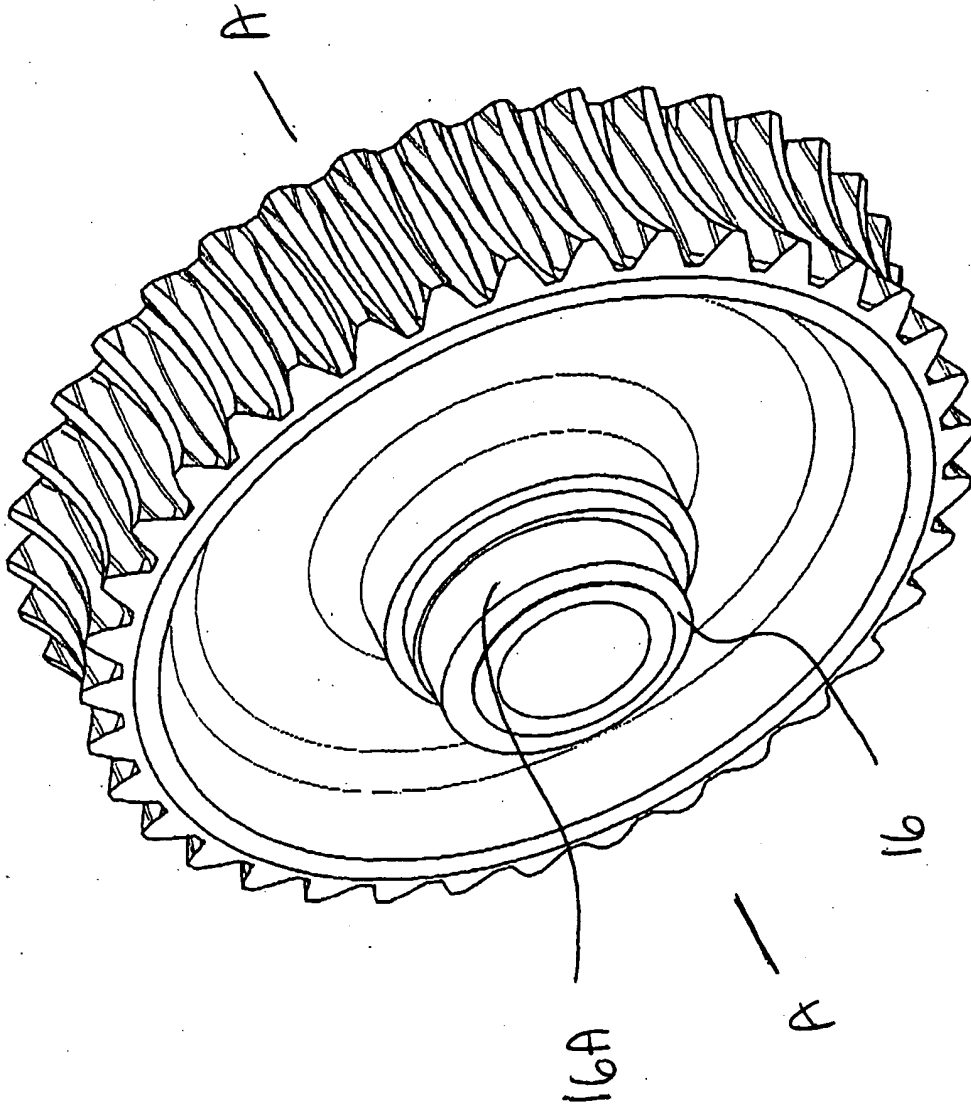


Fig 6

Fig 7



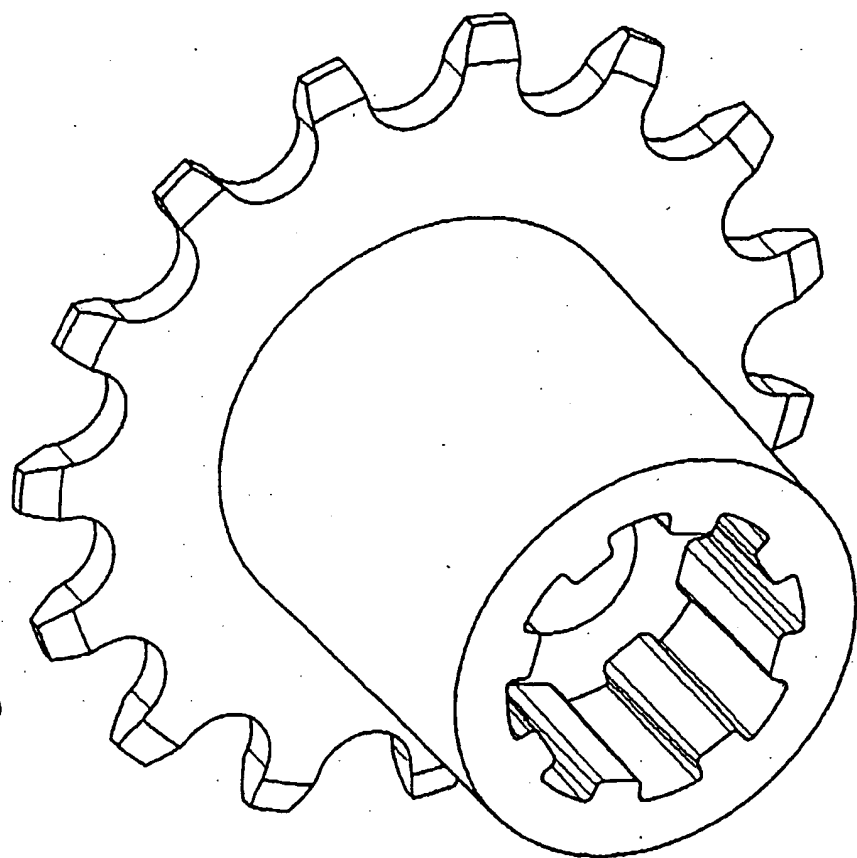


Figure 8

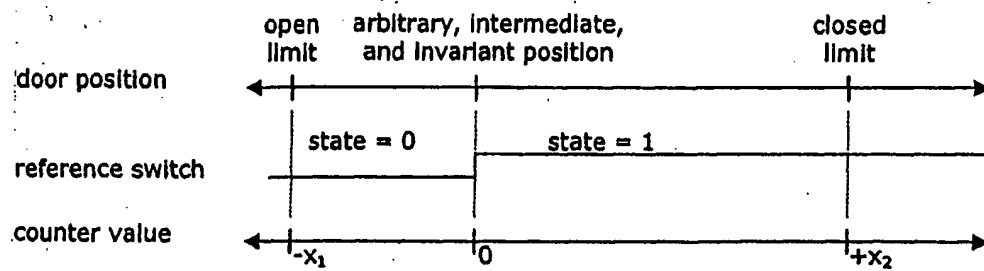


FIGURE 9

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